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A NATURAL-RESOURCE-BASED VIEW OF THE FIRM

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Historically, management theory has ignored the constraints imposed by the biophysical (natural) environment. Building upon resource-based theory, this article attempts to fill this void by proposing a *natural*-resource-based view of the firm—a theory of competitive advantage based upon the firm's relationship to the natural environment. It is composed of three interconnected strategies: pollution prevention, product stewardship, and sustainable development. Propositions are advanced for each of these strategies regarding key resource requirements and their contributions to sustained competitive advantage.

There has been an active debate among management scholars concerning the relative importance of internal firm capabilities (e.g., Galbraith & Kazanjian, 1986; Peters & Waterman, 1982; Prahalad & Hamel, 1990) versus environmental factors (e.g., Hannan & Freeman, 1977; Pfeffer & Salancik, 1978; Porter, 1980, 1990) to sustained competitive advantage. Evidence suggests, however, that both internal and external factors are crucial to competitive success (Fiegenbaum, Hart, & Schendel, In press; Hansen & Wernerfelt, 1989). In fact, many recent contributions attempt an integration of the internal and external perspectives under the banner of the "resource-based" view of the firm (e.g., Barney, 1991; Wernerfelt, 1984). Resource-based theory takes the perspective that valuable, costly-to-copy firm resources and capabilities provide the key sources of sustainable competitive advantage.

Without question, the resource-based view has generated a productive dialogue among previously isolated perspectives (Conner, 1991). However, this theory (like its more limited internal and external predecessors) still contains one serious omission: It systematically ignores the constraints imposed by the biophysical (natural) environment (e.g., Brown, Kane, & Roodman, 1994; Meadows, Meadows, & Randers, 1992). Historically, management theory has used a narrow and parochial concept of environment that emphasizes political, economic, social, and

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technological aspects to the virtual exclusion of the natural environment (Shrivastava, 1994; Shrivastava & Hart, 1992; Stead & Stead, 1992). Given the growing magnitude of ecological problems, however, this omission has rendered existing theory inadequate as a basis for identifying important emerging sources of competitive advantage. The goal of this article is, therefore, to insert the natural environment into the resource-based view—to develop a *natural*-resource-based view of the firm.

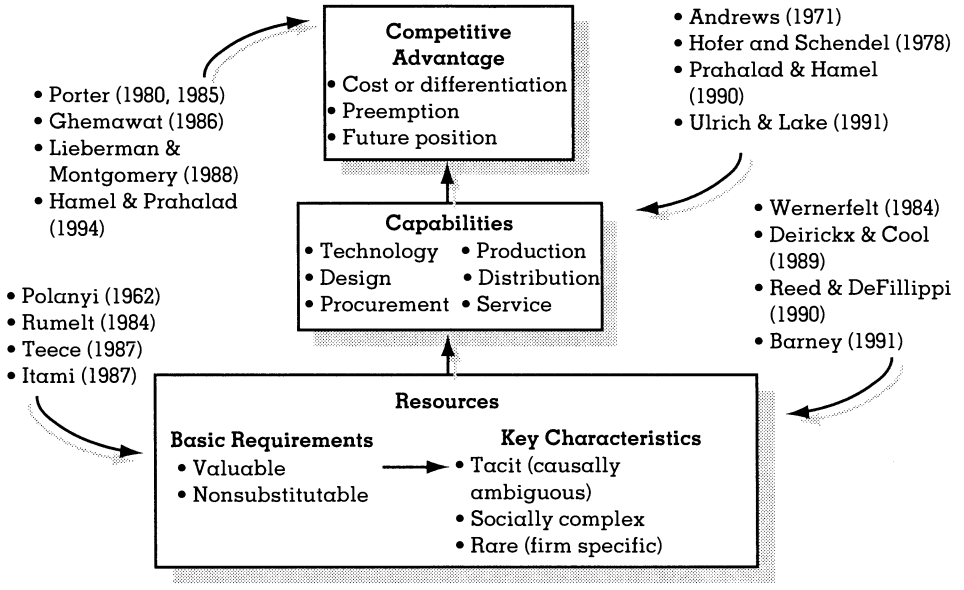
Accordingly, the first section of the paper reviews resource-based theory, highlighting the relationships among firm resources, capabilities, and sources of competitive advantage. Next, I discuss the driving forces behind the natural-resource-based view—the growing scale and scope of human activity and its potential for irreversible environmental damage on a global scale. The natural-resource-based view is then developed with the connection between the environmental challenge and firm resources operationalized through three interconnected strategic capabilities: pollution prevention, product stewardship, and sustainable development. Propositions are then developed connecting these strategies to key resource requirements and sustained competitive advantage. The article closes with suggestions for a future research agenda.

THE RESOURCE-BASED VIEW

Researchers in the field of strategic management have long understood that competitive advantage depends upon the match between distinctive internal (organizational) capabilities and changing external (environmental) circumstances (Andrews, 1971; Chandler, 1962; Hofer & Schendel, 1978; Penrose, 1959). However, it has only been during the past decade that a bona fide theory, known as the resource-based view of the firm, has emerged, articulating the relationships among firm resources, capabilities, and competitive advantage. Figure 1 provides a graphical summary of these relationships and some of the key authors associated with the core ideas.

The concept of competitive advantage has been treated extensively in the management literature. Porter (1980, 1985) thoroughly developed the concepts of cost leadership and differentiation relative to competitors as two important sources of competitive advantage: a *low-cost* position enables a firm to use aggressive pricing and high sales volume, whereas a *differentiated product* creates brand loyalty and positive reputation, facilitating premium pricing. Decisions concerning timing (e.g., moving early versus late) and commitment level (e.g., entering on a large scale versus more incrementally) also are crucial in securing competitive advantage (Ghemawat, 1986; Lieberman & Montgomery, 1988). If a firm makes an early move or a large-scale move, it is sometimes possible to preempt competitors by setting new standards or gaining preferred access to critical raw materials, locations, production capacity, or customers. *Preemptive commitments* thus enable firms to gain a strong focus and

FIGURE 1
The Resource-Based View



dominate a particular niche, either through lower costs, differentiated products, or both (Ghemawat, 1986; Porter, 1980). Finally, Hamel and Prahalad (1989, 1994) have emphasized the importance of "competing for the future" as a neglected dimension of competitive advantage. According to this view, the firm must be concerned not only with profitability in the present and growth in the medium term, but also with its *future position* and source of competitive advantage. This view requires explicit strategizing about how the firm will compete when its current strategy configuration is either copied or made obsolete.

The connection between firms' *capabilities* and competitive advantage also has been well established in literature. Andrews (1971) and, later, Hofer and Schendel (1978) and Snow and Hrebiniak (1980) noted the centrality of "distinctive competencies" to competitive success. More recently, Prahalad and Hamel (1990) and Ulrich and Lake (1991) reemphasized the strategic importance of identifying, managing, and leveraging "core competencies" rather than focusing only on products and markets in business planning. The resource-based view takes this thinking one step further: It posits that competitive advantage can be sustained only if the capabilities creating the advantage are supported by resources that are not easily duplicated by competitors. In other words, firms' resources must raise "barriers to imitation" (Rumelt, 1984). Thus, resources are the basic units of analysis and include physical and financial assets as well as employees' skills and organizational (social) processes. A firm's capabilities result from bundles of resources being brought to bear on

particular value-added tasks (e.g., design for manufacturing, just-in-time production).

Although the terminology has varied (Peteraf, 1993), there appears to be general agreement in the management literature about the resource characteristics that contribute to a firm's sustained competitive advantage. At the most basic level, such resources must be *valuable* (i.e., rent producing) and *nonsubstitutable* (Barney, 1991; Dierickx & Cool, 1989). In other words, for a resource to have enduring value, it must contribute to a firm capability that has competitive significance and is not easily accomplished through alternative means. Next, strategically important resources must be *rare* and/or *specific* to a given firm (Barney, 1991; Reed & DeFillippi, 1990). That is, they must not be widely distributed within an industry and/or must be closely identified with a given organization, making them difficult to transfer or trade (e.g., a brand image or an exclusive supply arrangement). Although physical and financial resources may produce a temporary advantage for a firm, they often can be readily acquired on factor markets by competitors or new entrants. Conversely, a unique path through history may enable a firm to obtain unusual and valuable resources that cannot be easily acquired by competitors (Barney, 1991).

Finally, and perhaps most important, such resources must be difficult to replicate because they are either *tacit* (*causally ambiguous*) or *socially complex* (Teece, 1987; Winter, 1987). Tacit resources are skill based and people intensive. Such resources are "invisible" assets based upon learning-by-doing that are accumulated through experience and refined by practice (Itami, 1987; Polanyi, 1962). Socially complex resources depend upon large numbers of people or teams engaged in coordinated action such that few individuals, if any, have sufficient breadth of knowledge to grasp the overall phenomenon (Barney, 1991; Reed & DeFillippi, 1990).

The strategic significance of firms' resources and capabilities has been heightened by recent observations that companies that are better able to understand, nurture, and leverage core competencies outperform those that are preoccupied with more conventional approaches to strategic business planning (Prahalad & Hamel, 1990). However, a firm's commitment to the existing competency base also may make it difficult to acquire new resources or capabilities. Put another way, the resource-based view may lead to an organization that is like the proverbial "child with a hammer"—everything starts looking like a nail. Technological discontinuities or shifts in external circumstances may render existing competencies obsolete or, at a minimum, invite the rapid development of new resources (Tushman & Anderson, 1986). Under such circumstances, core competencies might become "core rigidities" (Leonard-Barton, 1992). In this article, I argue that one of the most important drivers of new resource and capability development for firms will be the constraints and challenges posed by the natural (biophysical) environment.

THE CHALLENGE OF THE NATURAL ENVIRONMENT

> What defense has been to the world's leaders for the past 40 years, the environment will be for the next 40.
> *(The Economist,* 1990*)*

The above quote summarizes the immensity of the challenge posed by the natural environment. Consider that since the end of World War II,

- the human population has grown from about 2 billion to over 5 billion (Keyfitz, 1989);
- the global economy has grown over 15-fold (World Bank, 1992);
- consumption of fossil fuels has increased by a factor of 25 (Brown, Kane & Roodman, 1994); and
- industrial production has increased by a factor of 40 (Schmidheiny, 1992).

Unfortunately, the environmental impacts associated with this activity also have multiplied. For example, air and water pollution, toxic emissions, chemical spills, and industrial accidents have created regional environmental and public health crises for thousands of communities around the world (Brown, Kane, & Roodman, 1994; Shrivastava, 1987). The composition of the atmosphere has been altered more in the past 100 years—through fossil-fuel use, agricultural practices, and deforestation—than in the previous 18,000 (Graedel & Crutzen, 1989). Climate changes, which might produce both rising ocean levels and further desertification, could threaten the very fabric of human civilization as we know it (Schneider, 1989). The world's 18 major fisheries already have reached or exceeded maximum sustained yield levels (Brown & Kane, 1994). If current consumption rates continue, all virgin tropical forests will be gone within 50 years, with a consequent loss of 50 percent or more of the world's species (Wilson, 1989). Reduced quality of life in the developed world, severe human health problems, and environmentally induced political upheaval in the developing world could all result (Homer-Dixon, Boutwell, & Rathjens, 1993; Kaplan, 1994).

In short, the scale and scope of human activity have accelerated during the past 40 years to the point where they are now having impacts on a global scale. Consider, for example, that it took over 10,000 generations for the human population to reach 2 billion, but only a single lifetime to grow from 2 to over 5 billion (Gore, 1992). During the next 40 years, the human population is expected to double again, to 10 billion, before leveling off sometime in the middle of the next century (Keyfitz, 1989). Even with world GNP currently at about $25 trillion, it may be necessary to increase economic activity five- to tenfold just to provide basic amenities to this population (MacNeill, 1989; Ruckelshaus, 1989). This level of economic production probably will not be ecologically sustainable using existing technologies and production methods—a tenfold increase in resource use and waste generation would almost certainly

stress the earth's natural systems beyond recovery (Commoner, 1992; Meadows, Meadows, & Randers, 1992; Schmidheiny, 1992).

The next 40 years thus present an unprecedented challenge: either alter the nature of economic activity or risk irreversible damage to the planet's basic ecological systems. This portends nothing less than a "paradigm shift" for the field of strategic management because it appears that few, if any, of our past economic and organizational practices can be continued for long into the future; they are simply not environmentally sustainable. Over the next decade, businesses will be challenged to create new concepts of strategy, and it seems likely that the basis for gaining competitive advantage in the coming years will be rooted increasingly in a set of emerging capabilities such as waste minimization, green product design, and technology cooperation in the developing world (Gladwin, 1992; Hart, 1994; Kleiner, 1991; Schmidheiny, 1992). For the resource-based view to remain relevant, its creators must embrace and internalize the tremendous challenge created by the natural environment: Strategists and organizational theorists must begin to grasp how environmentally oriented resources and capabilities can yield sustainable sources of competitive advantage.

A NATURAL-RESOURCE-BASED VIEW OF THE FIRM

In the future, it appears inevitable that businesses (markets) will be constrained by and dependent upon ecosystems (nature).[1] In other words, it is likely that strategy and competitive advantage in the coming years will be rooted in capabilities that facilitate environmentally sustainable economic activity—a natural-resource-based view of the firm. In this section, I introduce a conceptual framework composed of three interconnected strategies: pollution prevention, product stewardship, and sustainable development. The significant driving forces behind each of these are briefly discussed, and an introduction to the key resources and sources of competitive advantage associated with each strategy is given (Table 1). Key resources and capabilities also affect the ability of the firm to sustain its competitive advantage. These theoretical linkages are developed in much greater depth in the section titled "Theory Development."

[1] In the long run, I argue that a natural-resource-based view is a physical (not a legal or regulatory) requirement. However, there may be temporary policy reversals that serve to slow this evolutionary path. For example, the current antiregulatory stance in the U.S. Congress suggests that domestic firms and international firms operating in the United States may be under less direct environmental regulatory pressure, at least for the next few years. This anomaly, however, neither nullifies the drivers for greening in other parts of the developed world, nor does it slow the need for rethinking corporate behavior in developing markets.

TABLE 1
A Natural-Resource-Based View: Conceptual Framework

Strategic Capability	Environmental Driving Force	Key Resource	Competitive Advantage
Pollution Prevention	Minimize emissions, effluents, & waste	Continuous improvement	Lower costs
Product Stewardship	Minimize life-cycle cost of products	Stakeholder integration	Preempt competitors
Sustainable Development	Minimize environmental burden of firm growth and development	Shared vision	Future position

Pollution Prevention

During the past decade there has been tremendous pressure for firms to minimize or eliminate emissions, effluents, and waste from their operations. In 1986, for example, the Superfund Amendments and Reauthorization Act (SARA) was passed in the United States, requiring that companies publicly disclose their emission levels of some 300 toxic or hazardous chemicals through what has become known as the toxic release inventory (TRI). Managers now understood the extent of their firms' impact on the environment and recognized that pollution stems from inefficient use of material and human resources. Indeed, the first year that the TRI was used (1988) revealed that U.S. companies alone emitted 10.4 billion pounds of toxic materials to the environment. This sobering realization caused management in the most affected industries—petrochemicals, pulp and paper, automotive, and electronics—to fundamentally rethink its approach to pollution abatement. In fact, since the late 1980s, a focus on emissions reduction and pollution abatement has swept industrial operations worldwide (Smart, 1992).

Pollution abatement can be achieved through two primary means: (a) *control:* emissions and effluents are trapped, stored, treated, and disposed of using pollution-control equipment or (b) *prevention:* emissions and effluents are reduced, changed, or prevented through better housekeeping, material substitution, recycling, or process innovation (Cairncross, 1991; Frosch & Gallopoulos, 1989; Willig, 1994). The latter approach reduces pollution during the manufacturing process while producing saleable goods. The former approach entails expensive, nonproductive pollution-control equipment. Pollution prevention thus appears analogous, in many respects, to total quality management (TQM); it requires extensive employee involvement and continuous improvement of emissions reduction, rather than reliance on expensive "end-of-pipe" pollution-control technology (Imai, 1986; Ishikawa & Lu, 1985; Roome, 1992).

Through pollution prevention, companies can realize significant savings, resulting in a cost advantage relative to competitors (Hart & Ahuja, 1994; Romm, 1994). Indeed, pollution prevention may save not only the cost of installing and operating end-of-pipe pollution-control devices, but

it also may increase productivity and efficiency (Smart, 1992; Schmidheiny, 1992). Less waste means better utilization of inputs, resulting in lower costs for raw materials and waste disposal (Young, 1991). Pollution prevention also may reduce cycle times by simplifying or removing unnecessary steps in production operations (Hammer & Champy, 1993; Stalk & Hout, 1990). Furthermore, pollution prevention offers the potential to cut emissions well below required levels, reducing the firm's compliance and liability costs (Rooney, 1993). Thus, a pollution-prevention strategy should facilitate lower costs, which, in turn, should result in enhanced cash flow and profitability for the firm. Indeed, pioneering programs like 3M's Pollution Prevention Pays (3P) and Dow's Waste Reduction Always Pays (WRAP) have produced hundreds of millions of dollars in cost savings over the past decade (Smart, 1992). At Dow, for example, it has been estimated that "end-of-pipe" pollution-control projects lose 16% on every dollar invested. Conversely, the return on pollution-prevention projects has averaged better than 60% for the past 10 years (Buzzelli, 1994).

Evidence also suggests that in the early stages of pollution prevention, there is a great deal of "low hanging fruit"—easy and inexpensive behavioral and material changes that result in large emission reductions relative to costs (Hart & Ahuja, 1994; Rooney, 1993). As the firm's environmental performance improves, however, further reductions in emissions become progressively more difficult, often requiring significant changes in processes or even entirely new production technology (Frosch & Gallopoulos, 1989). For example, a pulp plant might make significant reductions in emissions through better housekeeping, equipment maintenance, and incremental process improvement. Eventually, however, diminishing returns set in, and few significant additional reductions are possible without entirely new technology such as chlorine-free bleaching equipment to eliminate organochloride emissions. Thus, as the firm moves closer to "zero emissions," reductions will become more capital intensive and may require broader changes in underlying product design and technology (Walley & Whitehead, 1994).

Product Stewardship

As noted previously, pollution prevention focuses on new capability building in production and operations. However, activities at every step of the value chain—from raw material access, through production processes, to disposition of used products—have environmental impacts, and these will almost certainly need to be "internalized" in the future (Costanza, 1991; Daly & Cobb, 1989). Product stewardship thus entails integrating the "voice of environment," that is, external (stakeholder) perspectives, into product design and development processes (Allenby, 1991; Fiksel, 1993).

Indeed, during the past decade, virtually every major industrialized country in the world (except the United States) has adopted a government-sponsored program for certifying products as environmentally responsi-

ble (Abt Associates, 1993). In the United States, several competing private initiatives rate products on environmental criteria, including organizations such as Green Cross and Green Seal. A common feature of such programs is the use of some form of life-cycle analysis (LCA) (Davis, 1993). LCA is used to assess the environmental burden created by a product system from "cradle to grave" (Keoleian & Menerey, 1993). For a product to achieve low life-cycle environmental costs, designers need to (a) minimize the use of nonrenewable materials mined from the earth's crust, (b) avoid the use of toxic materials, and (c) use living (renewable) resources in accordance with their rate of replenishment (Robert, 1995). Also, the product-in-use must have a low environmental impact and be easily composted, reused, or recycled at the end of its useful life (Kleiner, 1991; Shrivastava & Hart, In press).

Such life-cycle thinking is being pushed even a step further. In 1990, for example, the German government proposed the first product "take-back" law (Management Institute for Environment and Business, 1993). According to this law, for selected industries (e.g., automobiles), customers were given the right to return spent products to the manufacturer at no charge. In turn, manufacturers would be prevented from disposing of these used or "junk" products. The specter of this law created a tremendous incentive for companies to learn to design products and packaging that could be easily composted, reused, or recycled in order to avoid what would become astronomical disposal costs and penalties. Similar initiatives are now being considered by the European Union, Japan, and even the United States.

It thus seems reasonable to conclude that firms in the developed markets will be driven increasingly to minimize the life-cycle environmental costs of their product systems. Through product stewardship, firms can (a) exit environmentally hazardous businesses, (b) redesign existing product systems to reduce liability, and (c) develop new products with lower life-cycle costs. The relative importance of these three activities will vary according to the nature of the firm's existing product portfolio. Proctor and Gamble, for example, has dedicated much of its product-stewardship efforts toward altering its core detergent and cleaning products, which historically have been based on phosphates and solvents. Church and Dwight, however, whose core products are based on environmentally benign baking soda, has been able to orient its product stewardship efforts around new product development in both the consumer and industrial markets. For start-up firms, product stewardship can form the cornerstone for firm strategy, because there are no preexisting commitments to products, facilities, or manufacturing processes.

However, because the market for "green" products is seldom large or lucrative early on (Roper, 1992), competitive advantage might best be secured initially through competitive preemption (Ghemawat, 1986; Lieberman & Montgomery, 1988). This advantage can be achieved through two primary means: (a) by gaining preferred or exclusive access to

important, but limited resources (e.g., raw materials, locations, productive capacity, or customers) or (b) by establishing rules, regulations, or standards that are uniquely tailored to the firm's capability.

Preferred access has provided the backbone for many successful competitive strategies (e.g., Wal-Mart's location-based preemption of rural markets for discount stores, Dupont's capacity-based preemption of the world titanium dioxide business). Several recent start-up ventures have used preferred access as a basis for product-stewardship strategies. For example, "Reclaim" is a start-up company whose proprietary product—cold-patch paving material for road repair—is made from recycled asphalt shingles. Although this product is patented and is highly functional at a reasonable cost, a key to the company's product-stewardship strategy was its ability to gain preferred access to the raw material (asphalt shingles from abandoned buildings).[2]

The second means for competitive preemption—raising barriers through the setting of rules, regulations, or standards—also has provided the basis for many successful competitive strategies (e.g., Matsushita's VHS strategy in video cassette recorders). BMW's product-stewardship strategy in automobile recycling offers a good example of preemption, both through preferred access and standard setting. In 1990, BMW initiated a "design-for-disassembly" process in Germany that it hoped would preempt the proposed government "take-back" policy described previously. By acting as the first mover, it was able to capture the few sophisticated German dismantler firms as part of an exclusive recycling infrastructure, thereby gaining a cost advantage over competitors who were left to fight over smaller, unlicensed operations or devote precious capital to building their own dismantling infrastructure. This move enabled BMW to build an early reputation by taking back and recycling its products that were already on the road as a precursor to the introduction of its new line of design-for-environment (DfE) automobiles. Once the company had developed and demonstrated the take-back infrastructure through its exclusive BMW dismantlers and disassemblers, executives succeeded in establishing the BMW approach as the German national standard. This move required other car companies to follow BMW's lead, but at substantially higher costs.

Market research suggests there is a vast amount of unclaimed reputation "space" with respect to corporate environmental performance. A

[2] Reclaim chose the New York/New Jersey region as its supply source, given the extensive building demolition and high landfill tipping fees in this area. Previously, scrap materials from demolished buildings were hauled to the landfill, at substantial cost to the contractor. Reclaim negotiated with the contractors for these asphalt shingles. The company gained exclusive access to a virtually free raw material, and the contractors avoided steep tipping fees. Furthermore, extensive building demolition and high tipping fees did not exist in any other major metropolitan area in the United States, making Reclaim's preemptive strategy virtually impregnable.

1991 Gallup Survey, for example, found that nearly 60% of Americans said that no company came to mind as being the most environmentally responsible in its behavior (Gallup Organization, 1991). A strategy of product stewardship with associated involvement of key external stakeholders (e.g., environmentalists, regulators) might therefore provide a means for claiming some of this reputation space. Xerox, for example, through its "asset-recycle-management" program treats its leased copiers as sources of high-quality, low-cost parts and components for their "new" machines. A sophisticated take-back and remanufacturing process allows these parts and components to be collected, reconditioned, tested, reassembled, and then sold in new "green" machines. Thus, through competitive preemption, product stewardship can create a base from which to build reputation and differentiate products by establishing the firm as an early mover in new (green) product domains.

Sustainable Development

Reducing emissions is the fundamental aim of pollution prevention, whereas product stewardship guides the selection of raw materials and disciplines product design with the objective of minimizing the environmental impact of product systems. Together, these two strategies help sever the negative links between business and environment in the developed markets of the North. A sustainable development strategy, however, also dictates that effort be made to sever the negative links between environment and economic activity in the developing countries of the South.

Until recently, most attention to environmental concerns has been focused in the North (e.g., the United States, Western Europe, Japan), which historically has accounted for over 80% of the economic and industrial activity, despite possessing less than 20% of the world's population (Cairncross, 1991; Schmidheiny, 1992). The Brundtland Report (World Commission on Environment and Development, 1987), however, clearly linked Third World development issues with environmental concerns: The cycle of debt, poverty, population growth, and resource depletion in the developing world was identified as a primary driving force behind such problems as desertification, deforestation, loss of biodiversity, and social-political disintegration (Ehrlich & Ehrlich, 1991; Homer-Dixon et al., 1993; Kaplan, 1994). Given that world population is projected to reach 10 billion by the mid-21st century (with 90% of the growth coming in the poor countries of the developing South), these problems appear destined to intensify (Keyfitz, 1989).

In order for this trend to be reserved, substantial economic development in the South appears essential because deepening poverty feeds the cycle of population growth and environmental degradation (Ruckelshaus, 1989). To provide even basic amenities for the burgeoning population in the developing world, economic activity would have to multiply at least five- to tenfold over current levels (MacNeill, 1989). In the future, therefore,

competing primarily in the developed markets of the United States, Western Europe, and Japan means focusing on a shrinking fraction of the world's markets. In fact, during the next decade, economic growth in the developing South is expected to be more than double that in the developed markets of the North (World Bank, 1992). General Electric's highly publicized shift in strategic focus from the United States and Europe to the developing markets of China, India, and Mexico reflects this growing realization (Smart, Engardio, & Smith, 1993). Unfortunately, this level of economic activity will probably not be ecologically sustainable with existing technologies and production methods. For example, if every family in China and India were supplied with a refrigerator and a car using current designs and power-generation technology, enough greenhouse gas would be produced to permanently alter the earth's atmosphere.

The challenge of sustainable development thus appears to have significant implications for firms, particularly large multinational corporations. First, it means recognizing the link between material consumption in the North and environmental degradation in the South (most products consumed in the North require raw materials or resources from the South). Sustainability might even imply that firms pursue strategies that actually *reduce* material and energy consumption in the North (Shrivastava & Hart, In press; Welford, 1995). Pacific Gas and Electric, for example, was successful at negotiating the first "demand-side management program" in California, which enabled it to become more profitable by selling less electricity (by sharing the savings from energy conservation with customers and rolling investments on customer premises into the rate base). Thus, sustainability strategies may seem counterintuitive, but they still hold the potential to confer competitive advantage.

Second, a sustainable development strategy means that firms must build markets in the South while reducing the environmental burden created by this new economic activity (Gladwin, 1992; Hart, 1994; Jansen & Vergragt, 1992). The Body Shop's "trade not aid" campaign, for example, is an explicit attempt to take materials from the developing world in a way that contributes to social and economic development while simultaneously ensuring the integrity of ecological systems (Roddick, 1991). Indeed, market research suggests that the environment is perceived as a critical problem both in developed as well as developing countries (The Roper Organization, 1992). Firms (either multinational or local) that are focused on generating short-term profits at the expense of the environment are therefore unlikely to establish long-term positions in the developing world. Successfully competing for these "markets of the future" may instead depend upon a firm's ability to envision sustainable technologies and products that do not yet exist and to stake them out ahead of the competition (Hamel & Prahalad, 1991, 1994).

As an example, Novo Nordisk, the fast-growing Danish pharmaceutical and biotechnology company, has been a pioneer in "green chemistry," that is, finding biological substitutes for synthetic chemicals. Novo's

commitment to this technology over the past two decades (before synthetic chemicals were widely perceived as environmentally unacceptable) has now placed it in the lead (with a 50% share) in the emerging world market for industrial enzymes and biological insecticides; it is well positioned for entry into developing countries with biological products for the agricultural and industrial sectors (Flynn, 1994).

For a firm, pursuing a sustainable development strategy thus implies both substantial investment and a long-term commitment to market development. There is little reason to believe that this investment will result in enhanced short-term profits. However, commitment to sustainable development might raise a firm's expectations for *future* performance relative to competitors, reflected by such measures as price earnings or market-to-book ratios. Sustainable development will likely require a concerted effort—a long-term vision—to leverage an environmentally conscious strategy into the developing world that includes low-impact technology and products as the basis for market entry and development (Schmidheiny, 1992).

THEORY DEVELOPMENT

The natural-resource-based view of the firm and its three interrelated strategies provide a conceptual framework for incorporating the challenge of the natural environment into strategic management. Beyond its use as a conceptual tool, however, the framework should also have predictive (and, ultimately, normative) value. In this section, I therefore develop a theoretical framework that can be used to guide future empirical work. Theory and associated propositions are developed around two major themes: (a) the linkage between the natural-resource-based view and *sustained competitive advantage* and (b) the *interconnections* among the three strategies.

Sustained Competitive Advantage

As noted in a previous section of this article, in order for a resource or capability to contribute to a sustained competitive advantage, it must possess certain properties. First, it must be valuable and nonsubstitutable. More important, however, the resource must be either *tacit* (causally ambiguous), *socially complex*, or *rare* (firm specific). This section presents propositions concerning how the natural-resource-based view can facilitate sustained competitive advantage by delineating the relationships among the three strategies and these key resource characteristics.

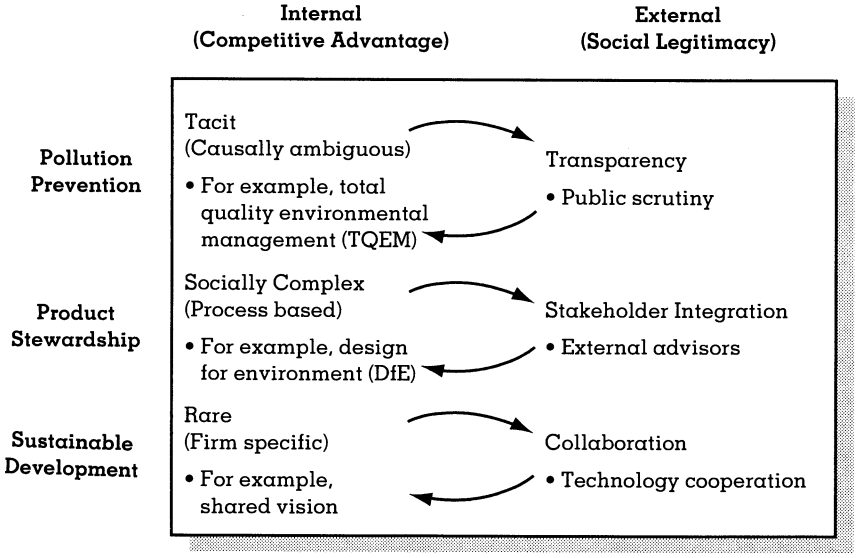
However, the management literature also suggests that a purely internal (competitive) approach may prove inadequate because issues of external (social) legitimacy and reputation are also extremely important (Gray & Wood, 1991; Westley & Vredenburg, 1991). Indeed, it has long been recognized that competitive advantage must be created within a broader scope of social legitimacy (Bozeman, 1987; DiMaggio & Powell,

1983; Meyer & Rowan, 1977; Selznick, 1957). I therefore also develop propositions suggesting where competitive strategy should give way to cooperative action (Bilimoria et al., 1995) in the interest of social legitimacy (Figure 2). Because the three environmental strategies are rooted in costly-to-copy firm resources and capabilities, it is argued that such an external (legitimacy-based) orientation in no way jeopardizes competitive advantage and may reinforce and differentiate the firm's position through the positive effects of a good reputation.

Pollution prevention. A pollution-prevention strategy seeks to reduce emissions using continuous-improvement methods focused on well-defined environmental objectives rather than relying on expensive "end-of-pipe" capital investments to control emissions (Rooney, 1993). Such a strategy is people intensive, and it depends upon tacit skill development through employee involvement (Cole, 1991; Lawler, 1986) and work in "green" teams (Makower, 1993; Willig, 1994). The decentralized and tacit nature of this capability makes it difficult to observe in practice (causally ambiguous) and, therefore, hard to duplicate quickly.

Although it might be argued that pollution prevention does nothing more than substitute labor (continuous improvement) for capital (end-of-pipe control technology), in practice it is often difficult to separate pollution prevention from other productive activities. For example, according to total quality management, business processes should not produce waste (time, effort, or materials). From this point of view, pollution is nothing more than a form of waste, which is to be eliminated in the pursuit of quality, that is, total quality *environmental* management (TQEM).

FIGURE 2
Sustained Competitive Advantage



Given the conceptual similarity between pollution prevention and TQM, it may be possible to accelerate the accumulation of resources in the former by integrating it into the latter (Roome, 1992). In firms that do not have well-developed quality-management processes, there could be barriers to implementing pollution prevention because the strategy requires the voluntary involvement of large numbers of people, especially line employees, in continuous-improvement efforts (Imai, 1986; Ishikawa & Lu, 1985). Pollution prevention should thus afford opportunity for a sustained competitive advantage through the accumulation of tacit (causally ambiguous) resources embedded in large numbers of people. Furthermore, because pollution prevention is people intensive, rather than technology intensive, firms should realize simultaneous reductions in both emissions and capital spending for pollution control (Buzzelli, 1994). This reasoning suggests the following propositions:

> *Proposition 1a: Those firms with demonstrated capability in TQM (tacit skills) will be able to accumulate the resources necessary for pollution prevention more quickly than firms without such prior capability.*
>
> *Proposition 1b: Firms that adopt pollution-prevention strategies will evidence simultaneous reductions in emissions and capital expenditures for pollution control.*

However, there appear to be limits to a strictly internal (competitive) pollution-prevention strategy. Increasingly, local communities and external stakeholders are demanding that corporate practices become more visible and transparent (Bozeman, 1987; Freeman, 1984; Roberts & King, 1989). To maintain legitimacy and build reputation, therefore, companies may need to open their operations to greater public scrutiny. Dow Chemical, for example, has incorporated the use of community advisory panels in most areas of the world where it has significant operations. Many voluntary codes of conduct (e.g., the *Valdez* Principles, Global Environmental Management Initiative, and the new ISO 14,000 Standards on Environmental Management) now stress the importance of openness and transparency. Significant numbers of major corporations have begun to publish voluntary annual environmental reports detailing emissions, spills, accidents, fines, and penalties as well as their accomplishments in pollution prevention. Given the tacit nature of the pollution-prevention capability, it would appear that transparency would not jeopardize a competitive advantage. On the contrary, it may enhance the image, reputation, and legitimacy of the firm. This background suggests the following proposition:

> *Proposition 1c: Over time, a pollution-prevention strategy will move from being an exclusively internal (competitive) process to an external (legitimacy-based) activity.*

Product stewardship. For a firm to realize product stewardship, a minimum requirement would seem to be that LCA be integrated into the firm's product-development process (Keoleian & Menerey, 1993). Beyond this, product stewardship also suggests that firms take an environmentally proactive stance toward raw material and component suppliers, which is aimed at minimizing the environmental impact of the entire supplier system (Smart, 1992). Close working relationships among environmental staff, marketing staff, and customers also appear important if the environmental impact of the product-in-use is to be minimized and the spent product reused or recycled (Hunt & Auster, 1990; Post & Altman, 1991).

Through initiatives to enhance quality and speed, many firms have already learned both the difficulty and importance of coordinating design with manufacturing and accessing the "voice of the customer" during the product-development process (Clark & Fujimoto, 1991; Denison, Hart, & Kahn, In press; Takeuchi & Nonaka, 1986). DfE means pushing these skills in cross-functional management a step further by seeking to deploy the "voice of the environment" into the selection of raw materials and the design of products (Allenby, 1991; Fiksel, 1993). Product stewardship thus implies an organizational ability not only to coordinate functional groups within the firm, but also to integrate the perspectives of key external stakeholders—environmentalists, community leaders, the media, regulators—into decisions on product design and development (Welford, 1993). Product stewardship should thus afford a firm the opportunity for sustained competitive advantage through accumulation of socially complex resources, involving fluid communication across functions, departments, and organizational boundaries. This discussion suggests the following propositions:

> *Proposition 2a: Firms with demonstrated capability in cross-functional management (socially complex skills) will be able to accumulate the resources necessary for product stewardship more quickly than firms without such prior capability.*
>
> *Proposition 2b: Firms that adopt product-stewardship strategies will evidence inclusion of external stakeholders in product-development and planning processes.*

Similar to pollution prevention, there appear to be limits to a strictly internal (competitive) product-stewardship strategy. Although competitive preemption creates initial competitive advantage, and LCA can be used as an internal planning tool to facilitate DfE, external stakeholders probably need to be involved substantially for the strategy to become accepted as socially legitimate (Buzzelli, 1991; Westley & Vredenburg, 1991). In fact, it has been argued that bringing stakeholders into the strategic process is the linchpin of a product-stewardship strategy (Thomlison, 1992). For example, Dow recently created a corporate advisory council composed primarily of environmentalists and scientists to provide

direct input to the Board concerning issues of strategy, investment, and policy. The success of this Council will hinge on management's ability to accept different points of view and incorporate new perspectives into the decision-making process. Furthermore, in order to create new standards and set new rules, the firm must collaborate with government regulators, as in the case of the BMW "take-back" strategy described previously. In short, the proactive involvement of environmentalists, media, and regulators appears essential if a strategy of product stewardship is to become credible. Thus, I suggest the following proposition:

> *Proposition 2c: Over time, a product-stewardship strategy will extend beyond the preemption of firm-specific resources and use of LCA to become a stakeholder-oriented (legitimacy-based) process.*

Sustainable development. A sustainable-development strategy is fostered by a strong sense of social-environmental purpose, which provides the backdrop for the firm's corporate and competitive strategies (Shrivastava & Hart, In press; Stikker, 1992; Welford, 1995). A firm's pursuit of sustainability thus implies working over an extended period to develop and deploy low-impact technologies, especially in the emerging markets of the South (Jansen & Vergragt, 1992; Schmidheiny, 1992).

Hamel and Prahalad (1989) observed that companies that were rising to positions of global leadership invariably began with ambitions that were out of proportion to their initial resources or capabilities. Organizationwide dedication to a compelling long-range vision (a shared vision or "intent") was the key to generating the internal pressure and enthusiasm needed for innovation and change. Creating such a shared vision of the future appears to require strong moral leadership (Bennis & Nanus, 1985; Selznick, 1957) and an empowering social process, reaching deep into the management ranks (Campbell & Yeung, 1991; Hart, 1992; Senge, 1990). Given the difficulty of generating such a consensus about a purpose, shared vision is a rare (firm-specific) resource, and few companies have been able to establish or maintain a widely shared or enduring sense of mission (Fiegenbaum, Hart, & Schendel, In press; Hamel & Prahalad, 1989).

Sustainable development appears to require such a shared vision of the future. In 1992, for example, Maurice Strong was appointed Chairman of Ontario Hydro after completing his work presiding over the Earth Summit in Brazil. Almost immediately, he created a Task Force to develop and recommend a strategy for sustainable development. The vision resulting from this process read as follows: "Ontario Hydro's Mission is to help Ontario to become the most energy efficient and competitive economy in the world, and a leading example of sustainable development in the world" (Henriques & Roome, 1994: 2). There are two important dimensions to this vision. First, Hydro will seek to lower energy consumption in the North (Ontario). Second, the utility will seek to transition from fossil fuel and nuclear capacity to renewable sources of energy production,

especially in the developing world—a daunting task requiring the decommissioning of several central power facilities.

The development of such new "sustainable" competencies and technologies will present fundamental challenges for virtually every industry in the coming decades. The specter of a "chlorine ban," for example, is already forcing rapid development of new technological competence in the chemical industry. Similarly, requirements for "zero-emission vehicles" in states like California have served as a significant impetus for technological change in the auto industry. Mazda, for example, appears committed to developing the world's first "clean" engine, using rotary technology, in response to the growing pressure around the world for air-pollution control and the reduction of carbon emissions. Indeed, CEO Yamamoto characterized the company's 20-year investment in rotary engine technology as a "sacred quest" (Denison, Hart, & Ichijo, 1994). Although this engine is not yet a commercial success, Mazda has steadfastly refused to give up on rotary technology. As a result of this commitment, Mazda is now very close to introducing a *hydrogen* rotary engine that emits water vapor as a combustion waste rather than the long list of serious pollutants and greenhouse gases associated with the conventional fossil-fuel-powered engine. Such a technology could have important environmental benefits, particularly in the developing world where the energy and transportation infrastructures are still being defined. Sustainable development should thus afford opportunity for sustained competitive advantage through accumulation of rare and firm-specific resources, involving a shared vision of the future and focus on new technology and competency development. This section suggests the following propositions:

> *Proposition 3a: Firms that have a demonstrated capability in establishing shared vision (rare skills) will be able to accumulate the resources necessary for sustainable development more quickly than firms without such prior capability.*
>
> *Proposition 3b: Firms that adopt sustainable-development strategies will evidence substantial development of new, low-impact technologies and competencies.*

Finally, there appear to be limits to an exclusively internal (competitive) strategy for sustainable development. Few companies have the capacity or market power to alter unilaterally entire sociotechnical systems. Even with its hydrogen rotary technology, for example, Mazda would need to redefine fuel and service infrastructures and change customer perceptions before its new technology would become commonplace. This example suggests the need for broader collaboration for system redesign. In Japan, for example, several new research and technology consortia have been created, including the Research Institute of Innovative Technology for the Earth (RITE). With funding and staff contributed from both

government and over 40 corporations, RITE has set forth an ambitious 100-year plan to create the next generation of power technology that eliminates or neutralizes greenhouse gas emissions (Hart, 1993).

Collaboration skills in the developing world also appear essential. Conventional multinational strategies (those aimed at securing access to labor, resources, or markets in exchange for capital investment or transfer of existing technologies) are commonly being questioned in many developing countries (Schmidheiny, 1992; Shiva, 1991). Witness, for example, China's recent policy to develop its automobile industry by matching domestic producers with foreign partners in joint ventures to produce cars specifically designed for the Chinese market.

Sustainable development thus implies *technology cooperation,* that is, working with host governments and businesses to build appropriate infrastructure, develop human resources, and nurture competitiveness (Schmidheiny, 1992). Merck, for example, entered into a long-term partnership for "chemical prospecting" in the Costa Rican rain forest with INBio, the National Institute for Biodiversity. Under the terms of the agreement, Merck donated equipment and paid INBio $1 million for a minimum number of plant and insect samples and the exclusive right to evaluate those samples for pharmaceutical applications for a defined period of time. INBio, which was responsible for the extraction, identification, and initial processing of the samples, would then receive a royalty on the sale of any drugs developed from INBio samples. Thus, this information suggests the following final proposition:

> *Proposition 3c: Over time, a sustainable-development strategy will extend beyond the firm to include collaboration among the public and private organizations needed to bring about substantial technological change.*

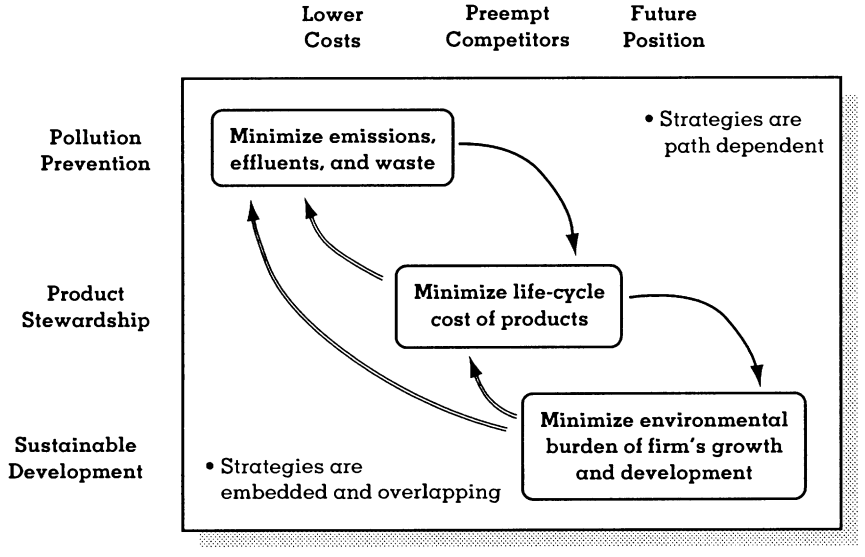
Interconnectedness

The three strategies associated with the natural-resource-based view of the firm appear to be interconnected. In the language of resource-based theory, interconnectedness means that (a) acquiring a certain resource might depend upon having already developed other resources first (Dierickx & Cool, 1989) or (b) a given capability depends on the simultaneous presence of other resources acquired due to a unique path through history (Barney, 1991). Interconnectedness thus consists of two seemingly paradoxical dimensions: path dependence and embeddedness. On the one hand, "path dependence" may suggest a particular sequence of resource accumulation—for example, early movers in pollution prevention may be better positioned to pursue product stewardship. On the other hand, "embeddedness" may make it more difficult to develop a new resource without others also being present—for example, product stewardship may be enhanced if a shared vision of sustainable development exists to help

focus and accelerate both resource and capability development. Figure 3 shows the hypothesized interconnections among the environmental strategies relative to the three dimensions of competitive advantage. Each is discussed in more detail next, along with some preliminary research propositions.

Path dependence. There is a certain sequential logic to the three environmental strategies. Without having first made significant progress on the pollution-prevention front, it might be difficult, if not impossible, to successfully adopt a product-stewardship strategy. If a firm attempts to differentiate products as "green" or environmentally responsible while continuing to produce high levels of production waste and emissions, it would seem risky because stakeholders (e.g., regulators, environmental groups) could easily expose this anomaly, destroying the firm's credibility and reputation. This relationship suggests a strong dependency of product stewardship on pollution prevention. 3M provides a case in point. Despite its reputation as a pioneer in pollution prevention, the recession in the early 1990s took a toll on 3M—annual sales growth averaged under 2% from 1991–1993. A radical transformation of the product-development process, however, emphasizing fast-cycle commercialization of "green" products helped to ignite sales, which were up 7% for 1994 (Kelly, 1994). It could be argued that 3M's unique path through history, as a pioneer in pollution prevention, provided the ideal platform from which to launch a product-stewardship strategy. Without this reputation, its product-stewardship efforts might have lacked credibility or been painted by the media as hypocritical. This discussion is stated in the form of the following proposition:

FIGURE 3
Interconnectedness



Proposition 4a: A firm's product stewardship is dependent upon its prior capability in pollution prevention.

Furthermore, a firm's successful pursuit of a sustainable-development strategy may be dependent upon having first demonstrated competence in product stewardship. In fact, early accumulation of resources in pollution prevention and product stewardship may provide the foundation upon which a sustainable-development strategy can be gradually added (Hart & Ahuja, 1994; Schmidheiny, 1992). As an example, in 1990, Dow Chemical (which had gained wide recognition for its initiatives in pollution prevention) decided to exit its lucrative 1,1,1-trichloroethane (TCE) solvent business well ahead of government regulations because of its high life-cycle environmental costs. (TCE is an ozone depleter and was going to be phased out under the Montreal Protocol later in the decade.) Investment was moved from this business to research and development into more benign substitute materials. In less than three years, a new business group—Advanced Cleaning Systems Division—was formed and four new (nonchlorinated) solvent products were on the market (product stewardship).

This decision may not seem especially significant until it is realized that the company exited the business *worldwide*. This included a rapidly growing TCE business in China, which (like most developing nations) was exempted from the Montreal Protocol until well into the next century. Dow recognized that rapid increases in the use of ozone-depleting substances in countries like China could have disastrous worldwide environmental consequences. The company has been working closely with Chinese business and government leaders to encourage adoption of substitute materials over the next several years (Buzzelli, 1994).

In short, through the establishment of a track record in pollution prevention and product stewardship in developed markets, it may be possible for a company to build a differentiated reputation, facilitating the gradual adoption of a sustainable-development strategy in the emerging markets of the South. Thus, successful pursuit of a sustainable-development strategy may require companies to "get on the escalator" of pollution prevention and product stewardship as first movers or risk being relegated to a semipermanent follower status. This discussion suggests the following proposition:

Proposition 4b: Sustainable development is dependent upon a firm's capability in pollution prevention and product stewardship.

Embeddedness. Even though the logic of path dependence is persuasive, there is a competing logic that highlights the importance of accumulating resources associated with the three strategies in parallel.[3] For

[3] I would like to thank one anonymous reviewer for pointing out the potential importance of overlap and embeddedness among the three strategies.

example, it can be argued that one of the most effective ways to prevent pollution is to alter the product design (product stewardship) rather than to seek only "process" changes (Allenby, 1991). Similarly, if pollution prevention can eliminate process steps, thereby cutting cycle times, it can clearly lead to faster response in the marketplace, facilitating a product-stewardship strategy. Furthermore, the cross-functional coordination and stakeholder integration associated with product stewardship might also help identify opportunities for reducing emissions, just as empowered employees and "green teams" might suggest improvements in products (Makower, 1993). In short, if a firm takes a purely sequential path, it may fail to take advantage of the clear synergies that exist across the strategies. Just as the product-development process is enhanced when design and manufacturing are planned concurrently, environmental performance also should be improved through the simultaneous (or at least overlapped) accumulation of pollution-prevention and product-stewardship capabilities. This suggests the following proposition:

> *Proposition 4c: Pollution prevention is embedded within product stewardship. That is, a product-stewardship strategy facilitates and accelerates capability development in pollution prevention and vice versa.*

Similarly, it can be argued that the shared vision associated with sustainable development applies to all three environmental strategies. A shared vision represents only a commitment to a general direction, not a rigid plan or blueprint for action (Senge, 1990). Operationalizing the vision means developing a series of specific programs and projects over time, in line with the "intent" (Hamel & Prahalad, 1989, 1994). These specific initiatives usually are delegated to people throughout the organization who have latitude to make local innovations guided by a common vision or "quest" (Hart, 1992). Thus, a shared vision of "sustainability" in a firm might help focus and even accelerate the pace of resource accumulation and capability building in pollution prevention and product stewardship, in addition to guiding shifts in technology and market focus called for by sustainable development. This again is an argument for a simultaneous (or at least overlapping) accumulation of resources for all three strategies. Thus, I offer the following, final proposition:

> *Proposition 4d: For a firm, product stewardship and pollution prevention are embedded within sustainable development. That is, a sustainable-development strategy facilitates and accelerates capability development in pollution prevention and product stewardship and vice versa.*

CONCLUSIONS AND FUTURE RESEARCH

In this article, I have argued that a limited view of what constitutes a firm's "environment" renders the resource-based view inadequate as a

basis for identifying important future sources of competitive advantage. Accordingly, this article proposed a *natural*-resource-based view of the firm, based upon the firm's relationship to the natural environment. Three interconnected strategies (pollution prevention, product stewardship, and sustainable development) were presented in detail, along with accompanying propositions concerning their connections to sustained competitive advantage.

Designing research to test the many propositions suggested as a part of the natural-resource-based view will require both methodological flexibility and patience, because much of the theory is prospective in nature (i.e., as of this writing, there were no examples, to my knowledge, of large manufacturing firms committed to a vision of sustainable development). Research on sustainable-development strategies must thus necessarily take a developmental, case-comparative approach. An interesting research project in this regard would be a comparative field study of two firms in a given industry: one moving toward sustainable development and the other resisting change. How do these two organizations differ? What is it that predisposes some firms to make the bold move ahead of others? Does internalizing such a vision speed the adoption of pollution-prevention and product-stewardship practices? Can the internal (competitive) aspects of the strategy be differentiated in time from the external (legitimacy) practices?

Research on product stewardship can take a somewhat more structured approach, given that some firms have begun to actively pursue this strategy. In this case, the ideal unit of analysis might be the product or product-development team, rather than the firm (e.g., Russo & Fouts, 1993). Using life-cycle analysis and environmental certification data (e.g., Council on Economic Priorities, 1991) a number of important questions are possible to examine: Which firms and industries are first movers in implementing a product-stewardship strategy? Does this strategy result in improved market position? Is life-cycle methodology adopted company-wide, or do pockets of innovation occur first, followed by the adoption by other product groups or business units? In moving toward product stewardship, do firms make a radical leap to internalizing the full life-cycle costs into the design of products, or can the process be accomplished more gradually? Are stakeholders involved gradually, or does this occur concurrently with the introduction of life-cycle analysis? A comparative study of several new product-development projects across firms that have strongly differing levels of cross-functional capacity might help to shed light on which corporate practices foster successful product stewardship.

Finally, hypothesis-testing work on pollution prevention can be started immediately, given the wide adoption of this strategy by existing firms. Environmental performance data on the S&P 500 are now readily available through such sources as the Toxic Release Inventory (TRI, 1988, 1991), the Council on Economic Priorities (CEP), and the Investor Responsibility Research Center's (IRRC) Corporate Environmental Profile.

Similar databases are emerging in Europe and Japan. By merging these sources with more conventional data on firm performance (e.g., Compustat), it should be possible to test the propositions directly, relating pollution-prevention practices to emissions and cost reduction. Such analyses also should facilitate a more detailed understanding of industry differences regarding the natural-resource-based view (e.g., manufacturing firms versus service firms or consumer products versus industrial products).

Thus, there is much work to be done examining the relationships among the three environmental strategies and indicators of financial and market performance. In my view, the natural-resource-based view of the firm opens a whole new area of inquiry and suggests many productive avenues for research over the next decade.

REFERENCES

Abt Associates. 1993. ***Status report on the use of environmental labels worldwide.*** Washington, DC: Environmental Protection Agency.

Allenby, B. 1991. Design for environment: A tool whose time has come. ***SSA Journal,*** September: 6–9.

Andrews, K. 1971. ***The concept of strategy.*** Homewood, IL: Irwin.

Barney, J. 1991. Firm resources and sustained competitive advantage. ***Journal of Management,*** 17: 99–120.

Bennis, W., & Nanus, B. 1985. ***Leaders.*** New York: Harper & Row.

Bilimoria, D., Cooperrider, D., Kaczmarski, K., Khalsa, G., Srivastva, S., & Upadhayaya, P. 1995. The organizational dimensions of global change: No limits to cooperation. ***Journal of Management Inquiry,*** 4(1): 71–90.

Bozeman, B. 1987. ***All organizations are public.*** San Francisco: Jossey-Bass.

Brown, L., & Kane, H. 1994. ***Full house.*** New York: Norton.

Brown, L., Kane, H., & Roodman, D. 1994. ***Vital signs.*** New York: Norton.

Buzzelli, D. 1991. Time to structure an environmental policy strategy. ***Journal of Business Strategy,*** 24 (March/April): 17–20.

Buzzelli, D. 1994. ***Second annual Nathan lecture in corporate environmental management.*** Ann Arbor: University of Michigan.

Cairncross, F. 1991. ***Costing the earth.*** Boston: Harvard Business School Press.

Campbell, A., & Yeung, S. 1991. Creating a sense of mission. ***Long Range Planning,*** 24: 10–20.

Chandler, A. 1962. ***Strategy and structure.*** Cambridge, MA: MIT Press.

Clark, K., & Fujimoto, T. 1991. ***Product development performance.*** Boston: Harvard Business School Press.

Cole, R. 1991. ***Strategies for learning.*** Berkeley: University of California Press.

Commoner, B. 1992. ***Making peace with the planet.*** New York: New Press.

Conner, K. 1991. A historical comparison of resource-based theory and five schools of thought within industrial organization economics: Do we have a new theory of the firm? ***Journal of Management,*** 17: 121–154.

Costanza, R. (Ed.). 1991. ***Ecological economics.*** New York: Columbia University Press.

Council on Economic Priorities. 1991. ***The better world investment guide.*** Englewood Cliffs, NJ: Prentice Hall.

Daly, H., & Cobb, J. (Eds.). 1989. ***For the common good.*** Boston: Beacon Press.

Davis, G. 1993. ***The use of life-cycle assessment in environmental labeling programs.*** Washington, DC: Environmental Protection Agency.

Denison, D., Hart, S., & Ichijo, K. 1994. ***Up against the walls: A comparison of cross-functional capability in U.S. and Japanese automobile companies.*** Working paper, Michigan Business School, Ann Arbor.

Denison, D., Hart, S., & Kahn, J. In press. From chimneys to cross-functional teams: Developing and validating a diagnostic model. ***Academy of Management Journal.***

Dierickx, I., & Cool, K. 1989. Asset stock accumulation and sustainability of competitive advantage. ***Management Science,*** 35: 1504–1511.

DiMaggio, P., & Powell, W. 1983. The iron cage revisited: Institutional isomorphism and collective rationality in organizational fields. ***American Sociological Review,*** 48: 147–160.

The Economist. 1990. 331(7663): 23–24.

Ehrlich, P., & Ehrlich, A. 1991. ***The population explosion.*** New York: Touchstone.

Fiegenbaum, A., Hart, S., & Schendel, D. In press. Strategic reference point theory. ***Strategic Management Journal.***

Fiksel, J. 1993. Design for environment: The new quality imperative. ***Corporate Environmental Strategy,*** 1: 49–55.

Flynn, J., 1994. Novo Nordisk's mean green machine. ***Business Week,*** November 14: 72–75.

Freeman, E. 1984. ***Strategic management: A stakeholder approach.*** Boston: Pitman.

Frosch, R., & Gallopoulos, N. 1989. Stategies for manufacturing. ***Scientific American,*** September: 144–152.

Galbraith, J., & Kazanjian, R. 1986. ***Strategy implementation.*** St. Paul, MN: West.

Gallup Organization. 1991. ***Survey of environmental attitudes and behavior—North America.*** Washington, DC: Author.

Ghemawat, P. 1986. Sustainable advantage. ***Harvard Business Review,*** 64(5): 53–58.

Gladwin, T. 1992. The meaning of greening: A plea for organizational theory. In K. Fischer & J. Schot (Eds.), ***Environmental strategies for industry:*** 37–62. Washington, DC: Island Press.

Gore, A. 1992. ***Earth in the balance.*** Boston: Houghton-Mifflin.

Graedel, T., & Crutzen, P. 1989. The changing atmosphere. ***Scientific American,*** September: 58–68.

Gray, B., & Wood, D. 1991. Collaborative alliances: Moving from practice to theory. ***Journal of Applied Behavioral Science,*** 27: 3–22.

Hamel, G., & Prahalad, C. K. 1989. Strategic intent. ***Harvard Business Review,*** 67(3): 63–76.

Hamel, G., & Prahalad, C. K. 1991. Corporate imagination and expeditionary marketing. ***Harvard Business Review,*** 69(4): 81–92.

Hamel, G., & Prahalad, C. K. 1994. ***Competing for the future.*** Boston: Harvard Business School Press.

Hammer, M. & Champy, J. 1993. ***Reengineering the corporation.*** New York: HarperBusiness.

Hannan, M., & Freeman, J. 1977. The population ecology of organizations. ***American Journal of Sociology,*** 82: 929–964.

Hansen, G., & Wernerfelt, B. 1989. Determinants of firm performance: The relative importance of economic and organizational factors. ***Strategic Management Journal,*** 10: 399–411.

Hart, S. 1992. An integrative framework for strategy-making processes. ***Academy of Management Review,*** 17: 327–351.

Hart, S. 1993. Commentary: Sustainable strategy in a greening world. ***Advances in Strategic Management,*** 9: 93–97.

Hart, S. 1994. How green production might sustain the world. ***Journal of the Northwest Environment,*** 10: 4–14.

Hart, S., & Ahuja, 1994. ***Does it pay to be green? An empirical examination of the relationship between pollution prevention and firm performance.*** Working paper, University of Michigan, Ann Arbor.

Henriques, I., & Roome, N. 1994. ***A case study of Ontario Hydro: A strategy for sustainable energy development and use.*** Ontario, Canada: York University.

Hofer, C., & Schendel, D. 1978. ***Strategy formulation: Analytical concepts.*** St. Paul, MN: West.

Homer-Dixon, T., Boutwell, J., & Rathjens, G. 1993. Environmental change and violent conflict. ***Scientific American,*** 268(2): 38–45.

Hunt, C., & Auster, E. 1990. Proactive environmental management: Avoiding the toxic trap. ***Sloan Management Review,*** 31: 7–18.

Imai, M. 1986. ***Kaizen.*** New York: Random House.

Ishikawa, K., & Lu, D. 1985. ***What is total quality control?*** Englewood Cliffs, NJ: Prentice Hall.

Itami, H. 1987. ***Mobilizing invisible assets.*** Cambridge, MA: Harvard University Press.

Jansen, J. L. A., & Vergragt, Ph. J. 1992. ***Sustainable development: A challenge to technology.*** The Hague: Dutch Ministry of Housing, Physical Planning, and the Environment.

Kaplan, R. 1994. The coming anarchy. ***Atlantic Monthly,*** February: 44–76.

Kelly, K. 1994. The drought is over at 3M. ***Business Week,*** November 7: 140–141.

Keoleian, G., & Menerey, D. 1993. ***Life cycle design guidance manual.*** Cincinnati, OH: Environmental Protection Agency.

Keyfitz, N. 1989. The growing human population. ***Scientific American,*** September: 119–126.

Kleiner, A. 1991. What does it mean to be green? ***Harvard Business Review,*** 69(5): 38–47.

Lawler, E. 1986. ***High-involvement management.*** San Francisco: Jossey-Bass.

Leonard-Barton, D. 1992. Core capabilities and core rigidities: A paradox in managing new product development. ***Strategic Management Journal,*** 13: 111–125.

Lieberman, M., & Montgomery, D. 1988. First mover advantages. ***Strategic Management Journal,*** 9 [Special issue]: 41–58.

MacNeill, J. 1989. Strategies for sustainable economic development. ***Scientific American,*** September: 155–165.

Makower, J. 1993. ***The E factor.*** New York: Times Books.

Management Institute for Environment and Business. 1993. ***Baverische Motoren Werke AG.*** Washington, DC: Author.

Meadows, D., Meadows, D., & Randers, J. 1992. ***Beyond the limits.*** Post Mills, VT: Chelsea Green Publishing.

Meyer, J., & Rowan, B. 1977. Institutionalized organizations: Formal structure as myth and ceremony. ***American Journal of Sociology,*** 83: 340–363.

Penrose, E. 1959. ***The theory of the growth of the firm.*** New York: Wiley.

Peteraf, M. 1993. The cornerstones of competitive advantage: A resource-based view. ***Strategic Management Journal,*** 14: 179–191.

Peters, T., & Waterman, R. 1982. ***In search of excellence.*** New York: Harper & Row.

Pfeffer, J., & Salancik, J. 1978. ***The external control of organizations.*** New York: Harper & Row.

Polanyi, M. 1962. ***Personal knowledge: Towards a post-critical philosophy.*** Chicago: University of Chicago Press.

Porter, M. 1980. ***Competitive strategy.*** New York: Free Press.

Porter, M. 1985. ***Competitive advantage.*** New York: Free Press.

Porter, M. 1990. ***The competitive advantage of nations.*** New York: Free Press.

Post, J., & Altman, B. 1991. ***Corporate environmentalism: The challenge of organizational learning.*** Paper presented at the annual meeting of the Academy of Management, Miami Beach, FL.

Prahalad, C. K., & Hamel, G. 1990. The core competence of the corporation. ***Harvard Business Review,*** 68(3): 79–91.

Reed, R., & DeFillippi, R. 1990. Causal ambiguity, barriers to imitation, and sustainable competitive advantage. ***Academy of Management Review,*** 15: 88–102.

Robert, K-H. 1995. The natural step. ***Timeline,*** March/April: 1–24.

Roberts, N., & King, P. 1989. The stakeholder audit goes public. ***Organizational Dynamics,*** 17(3): 63–79.

Roddick, A. 1991. ***Body and soul.*** New York: Crown Publishers.

Romm, J. 1994. ***Lean and clean management.*** New York: Kodansha International.

Roome, N. 1992. Linking quality and the environment. ***Business Strategy and the Environment,*** 1: 11–24.

Rooney, C. 1993. Economics of pollution prevention: How waste reduction pays. ***Pollution Prevention Review,*** 3(Summer): 261–276.

The Roper Organization. 1992. ***Environmental behavior, North America.*** New York: Author.

Ruckelshaus, W. 1989. Toward a sustainable world. ***Scientific American,*** September: 166–175.

Rumelt, R. 1984. Toward a strategic theory of the firm. In R. Lamb (Ed.), ***Competitive strategic management:*** 556–570. Englewood Cliffs, NJ: Prentice Hall.

Russo, M., & Fouts, P. 1993. ***The green carrot: Do markets reward corporate environmentalism?*** Working paper, College of Business Administration, University of Oregon.

Schmidheiny, S. 1992. ***Changing course.*** Cambridge, MA: MIT Press.

Schneider, S. 1989. The changing climate. ***Scientific American,*** September: 70–79.

Selznick, P. 1957. ***Leadership in administration.*** New York: Harper & Row.

Senge, P. 1990. ***The fifth discipline.*** New York: Doubleday.

Shiva, V. 1991. ***Ecology and the politics of survival.*** New Delhi: Sage.

Shrivastava, P. 1987. ***Bhopal: Anatomy of a crisis,*** Cambridge, MA: Ballinger.

Shrivastava, P. 1991. Castrated environment: Greening organizational science. ***Organization Studies,*** 15: 705–726.

Shrivastava, P., & Hart, S. 1992. Greening organizations. ***Academy of Management Best Paper Proceedings,*** 52: 185–189.

Shrivastava, P., & Hart, S. In press. Creating sustainable corporations. ***Business Strategy and the Environment.***

Smart, B. (Ed.). 1992. ***Beyond compliance: A new industry view of the environment.*** Washington, DC: World Resources Institute.

Smart, T., Engardio, P., & Smith, G. 1993. GE's brave new world. ***Business Week.*** November 8: 64–70.

Snow, C., & Hrebiniak, L. 1980. Strategy, distinctive competence, and organizational performance. ***Administrative Science Quarterly,*** 25: 317–335.

Stalk, G., & Hout, T. 1990. ***Competing against time.*** New York: Free Press.

Stead, W. E., & Stead, J. 1992. ***Management for a small planet.*** Newbury Park, CA: Sage.

Stikker, A. 1992. Sustainability and business management. ***Business Strategy and the Environment,*** 3(Autumn): 1–8.

Takeuchi, H., & Nonaka, I. 1986. The new new product development game. ***Harvard Business Review,*** 64(1): 137–146.

Teece, D. 1987. Profiting from technological innovation: Implications for integration, collaboration, licensing, and public policy. In D. Teece (Ed.), ***The competitive challenge:*** 185–220. Cambridge, MA: Ballinger.

Thomlison, B. 1992. Environmental consumerism must meet needs of corporate stakeholders. ***Marketing News,*** 26(9): 12.

TRI. 1988. ***National economic, social, and environmental data bank.*** Washington, DC: Environmental Protection Agency.

TRI. 1991. ***National economic, social, and environmental data bank.*** Washington, DC: Environmental Protection Agency.

Tushman, M., & Anderson, P. 1986. Technological discontinuities and organizational environments. ***Administrative Science Quarterly,*** 31: 439–465.

Ulrich, D., & Lake, D. 1991. ***Organizational capability.*** New York: Wiley.

Walley, N., & Whitehead, B. 1994. ***Harvard Business Review,*** 72(3): 46–52.

Welford, R. 1993. Breaking the link between quality and the environment: Auditing for sustainability and life cycle analysis. ***Business Strategy and the Environment,*** 4(Winter): 25–33.

Welford, R. 1995. ***Environmental strategy and sustainable development.*** London: Routledge.

Wernerfelt, B. 1984. A resource-based view of the firm. ***Strategic Management Journal,*** 5: 171–180.

Westley, F., & Vrendenburg, H. 1991. Strategic bridging: The collaboration between environmentalists and business in the making of green products. ***Journal of Applied Behavioral Science,*** 27: 65–90.

Willig, J. (Ed.). 1994. ***Environmental TQM.*** New York: McGraw-Hill.

Wilson, E. 1989. Threats to biodiversity. ***Scientific American,*** September: 108–116.

Winter, S. 1987. Knowledge and competence as strategic assets. In D. Teece (Ed.), ***The competitive challenge:*** 159–184. Cambridge, MA: Ballinger.

World Bank. 1992. ***Development and the environment.*** New York: Oxford University Press.

World Commission on Environment and Development. 1987. ***Our common future.*** New York: Oxford University Press.

Young, J. 1991. Reducing waste, saving materials. In L. Brown et al. (Eds.), ***State of the World:*** 39–55. New York: Norton.

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